AQA

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Chemistry Paper 2H

Time allowed: 1 hour 15 minutes

Materials
For this paper you must have:
- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

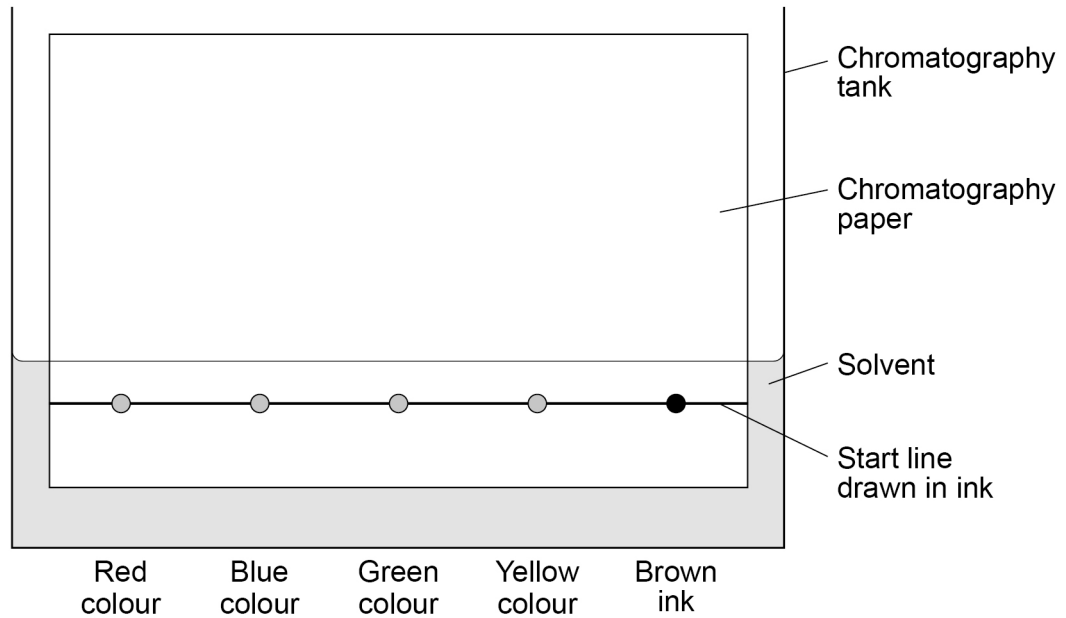| For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

0 1 A student investigated the colours in a brown ink using chromatography.

0 1 . 1 **Figure 1** shows the apparatus used.

Figure 1

Red colour   Blue colour   Green colour   Yellow colour   Brown ink

Give **two** errors made by the student.

Describe the problem each error would cause.

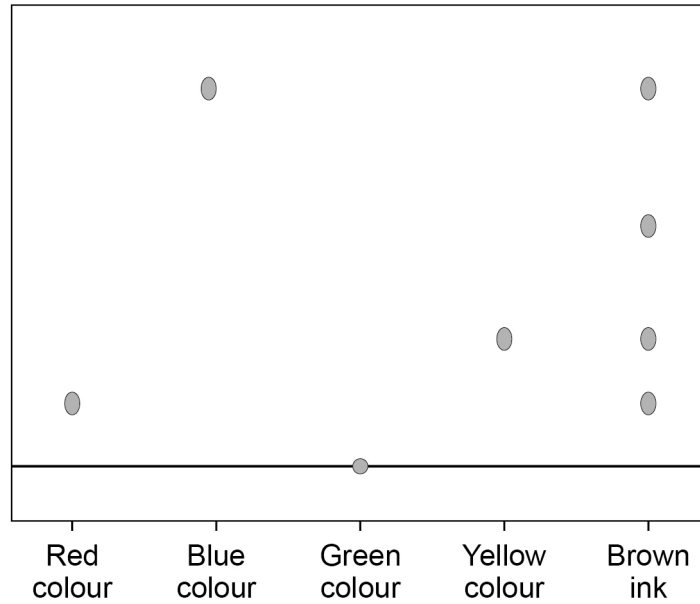**[4 marks]**

Error 1 _____

_____

Problem 1 _____

_____

Error 2 _____

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Problem 2 _____

_____

A different student set up the apparatus correctly.

Figure 2 shows the results.

Figure 2

| Red colour | Blue colour | Green colour | Yellow colour | Brown ink |

0 1 . 2   Give **two** conclusions the student can make from **Figure 2** about the four colours in the brown ink.

[2 marks]

1 _____

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2 _____

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Question 1 continues on the next page

Turn over ▶

0 1 . 3 Why was the green colour still on the start line at the end of the experiment?

[1 mark]

Tick (✓) **one** box.

The experiment was left for too long. ☐

The green colour was insoluble in the solvent. ☐

The green spot contained too many colours. ☐

The green spot was too small. ☐

0 1 . 4 A student calculated the R_f value of a colour to be 0.24

The colour moved 1.8 cm from the start line.

Calculate the distance the solvent moved.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[3 marks]

Distance moved by solvent = _____ cm

10

0 2 . 1 Water that is safe to drink is called potable water.

Compare how easily potable water can be obtained from:

- waste water (sewage)
- ground water (fresh water).

[6 marks]

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Question 2 continues on the next page

Turn over ▶

A scientist produced potable water from 150 cm^3 of salty water.

0 2 . 2 Which process can be used to produce potable water from salty water?

[1 mark]

Tick (✓) **one** box.

Distillation ☐

Electrolysis ☐

Filtration ☐

Sterilisation ☐

0 2 . 3 The salty water contains sodium chloride.

The scientist collected 2.40 g of sodium chloride from 150 cm^3 of salty water.

Calculate the concentration of sodium chloride in grams per dm^3

[3 marks]

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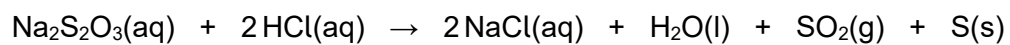
_____

Concentration of sodium chloride = _____ g/dm^3

10

0 3 This question is about the reaction between sodium thiosulfate solution and hydrochloric acid.

The equation for the reaction is:

$$Na_2S_2O_3(aq) \ + \ 2\,HCl(aq) \ \rightarrow \ 2\,NaCl(aq) \ + \ H_2O(l) \ + \ SO_2(g) \ + \ S(s)$$

0 3 . 1 The mass of the conical flask and contents was greater at the start of the reaction than at the end.
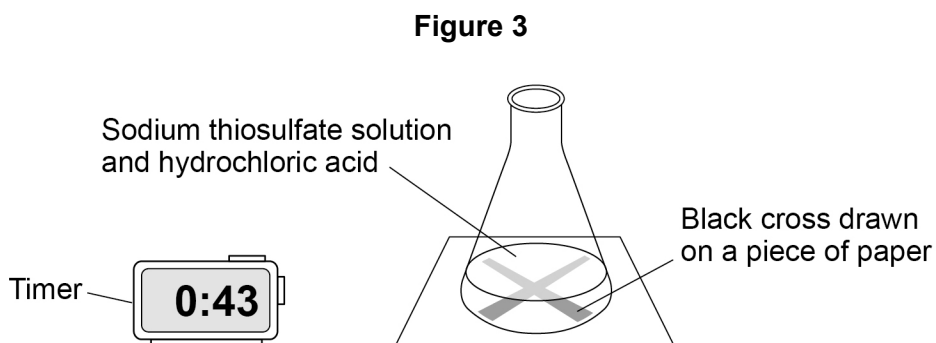
Explain why.

[2 marks]

Question 3 continues on the next page

Turn over ▶

A teacher demonstrated the reaction between sodium thiosulfate solution and hydrochloric acid.

Figure 3 shows the experiment.

The experiment was done in a fume cupboard.

Figure 3

Sodium thiosulfate solution and hydrochloric acid

Black cross drawn on a piece of paper

Timer — 0:43

This is the method the teacher used.

1. Pour 50 cm³ of sodium thiosulfate solution into a conical flask.

2. Put the conical flask on a black cross drawn on a piece of paper.

3. Pour 10 cm³ of hydrochloric acid into the conical flask and start a timer.

4. Stop the timer when the cross can no longer be seen.

5. Repeat the experiment at different temperatures.

| 0 | 3 |.| 2 | What type of variable is time in this reaction?

[1 mark]

Tick (✓) **one** box.

Control ☐

Dependent ☐

Independent ☐

0 3 . 3   **Table 1** shows the results.

Table 1

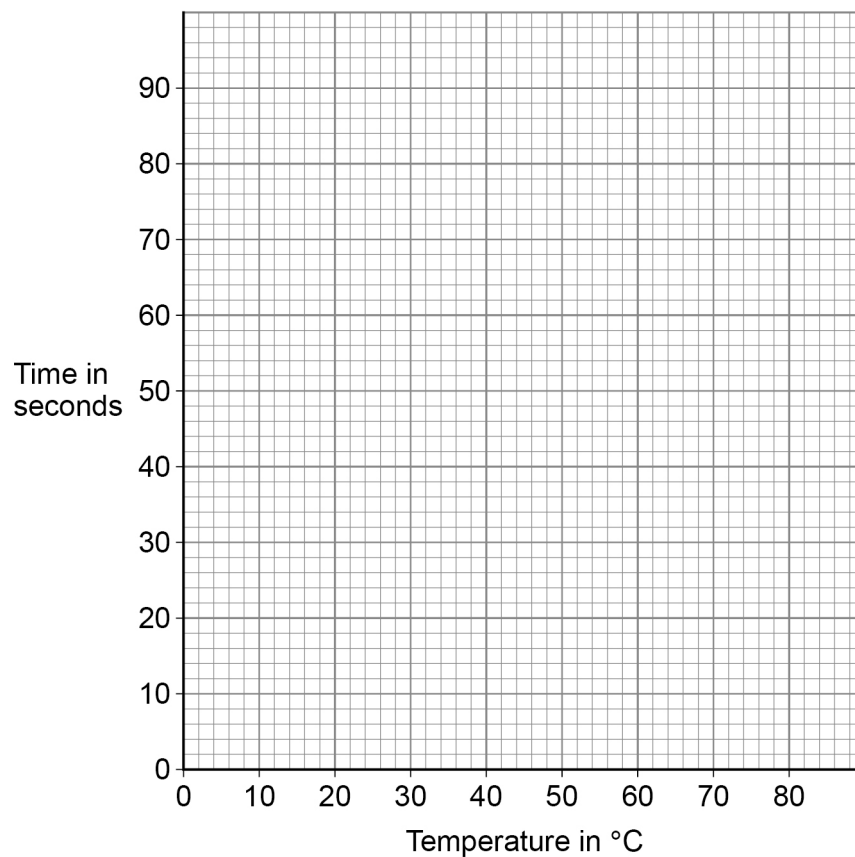| Temperature in °C	Time in seconds
19	82
32	48
45	43
52	15
63	7
73	3

Complete **Figure 4**.

You should:

- plot the data from **Table 1** on **Figure 4**
- draw a line of best fit.
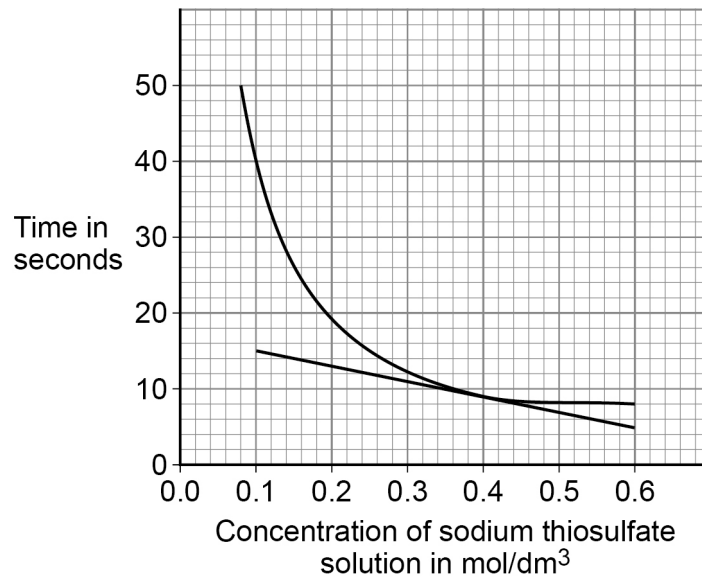
[3 marks]

Figure 4

Turn over ▶

0 3 . 4 A student investigated the effect of concentration of sodium thiosulfate on the time taken for the reaction at room temperature.

Figure 5 shows the results with a tangent drawn at 0.4 mol/dm^3

Figure 5

Calculate the gradient (slope) of the tangent at 0.4 mol/dm^3

Give the unit.

[4 marks]

Gradient = _____

Unit = _____

0 3 . 5 The student determined the **rate** of the reaction at regular time intervals during an experiment.

Explain why the **rate** decreased during the reaction.

You should give your answer in terms of particles.

[2 marks]

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12

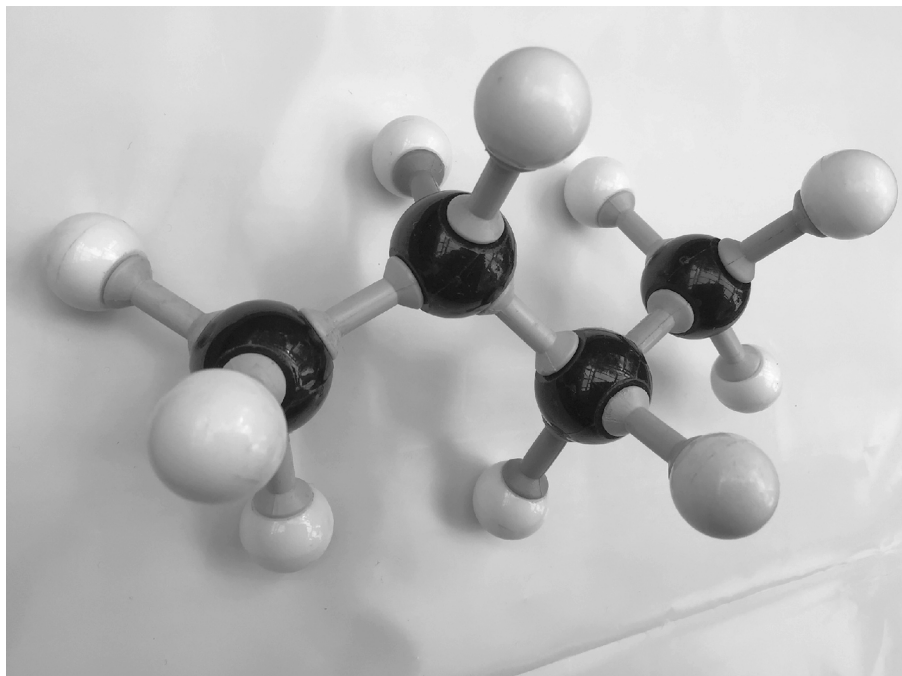**Turn over for the next question**

Turn over ▶

0 4 This question is about hydrocarbons and the uses of hydrocarbons.

0 4 . 1 **Figure 6** shows a model of an alkane.

Figure 6

What is the name of the alkane in **Figure 6**?

[1 mark]

_____

0 4 . 2 What is a hydrocarbon?

[1 mark]

_____

_____

Large hydrocarbon molecules are cracked.

0 4 . 3 When $C_{11}H_{24}$ is cracked, three products are formed.

Complete the equation for the reaction.

[2 marks]

$$C_{11}H_{24} \rightarrow C_5H_{10} + 2 \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

0 4 . 4 Explain why **one** of the products of cracking is in high demand.

[2 marks]

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Question 4 continues on the next page

Turn over ▶

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0 4 . 5   Window frames can be manufactured from wood or from plastic.

Table 2 shows data from a life cycle assessment (LCA) for a wooden window frame and a plastic window frame.

Both window frames are the same size.

Table 2

	Wood	Plastic
Sources of hydrocarbons used for production in kg	5.37	18.23
Greenhouse gases released during production, use and disposal in kg equivalent of CO_2	457	487
Oxides of nitrogen and sulfur dioxide produced in arbitrary units	29.6	37.7
Waste materials in kg	16.5	28.8
Total energy consumption in production, use and disposal in MJ	9150	9713
Lifetime cost to customer to buy and maintain in £	147	102

Evaluate the sustainability of wooden and plastic window frames.

You should include environmental and economic factors.

[6 marks]

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12

Turn over for the next question

Turn over ▶

0 5 This question is about the Earth's atmosphere and the Earth's resources.

0 5 . 1 After the formation of the Earth's early atmosphere, the amounts of nitrogen and oxygen in the atmosphere changed.

Explain the main changes in the amounts of nitrogen and oxygen in the Earth's atmosphere.

[4 marks]

Nitrogen _____

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Oxygen _____

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0 5 . 2 Describe how coal was formed from the carbon dioxide present in the Earth's early atmosphere.

[4 marks]

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0 5 . 3 The combustion of 1.0 kg of coal produces more carbon dioxide than the combustion of 1.0 kg of natural gas.

Suggest why.

[1 mark]

_____

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Metals are extracted from metal ores found in the Earth.

0 5 . 4 Describe how bioleaching is used to extract copper from low grade ores.

[3 marks]

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0 5 . 5 Phytomining uses plants to extract nickel from low grade ores.

The plants contain 0.792% nickel by mass.

The plants are burned to produce ash.

The ash from these plants contains 4.80% nickel by mass.

Calculate the mass of ash produced from burning 1000 kg of plants.

Give your answer in grams in standard form.

[4 marks]

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Mass of ash (in standard form) = _____ g

16

Turn over ▶

0 6 This question is about catalysts and equilibrium.

0 6 . 1 What type of substance is a catalyst in biological systems?

[1 mark]

Tick (✓) **one** box.

Algae ☐

Alkene ☐

Enzyme ☐

Formulation ☐

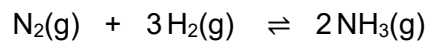**0 6 . 2** Explain how a catalyst increases the rate of a reaction.

[2 marks]

The reversible reaction for the production of ammonia is:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

0 6 . 3 What can scientists predict using Le Chatelier's Principle?

[1 mark]

0 6 . 4 Describe how a reversible chemical reaction is able to reach equilibrium.

[2 marks]

0 6 . 5 Explain the effect of increasing the pressure on the yield of ammonia.

[2 marks]

0 6 . 6 The forward reaction to produce ammonia is exothermic.

Explain the effect of increasing the temperature on the yield of ammonia.

[2 marks]

10

END OF QUESTIONS

There are no questions printed on this page

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